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This disposes of every case except when m is a multiple of 60 but not of 180. In this case $\sin n\theta = \pm \frac{1}{2} \sqrt{3}$, and by (3), $\sin \theta$ is irrational.

It has now been shown that the sine of every rational angle not a multiple of 30° is irrational. Obviously this establishes the theorem for the cosine, secant, and cosecant functions as well.

An analogous theorem, differing only in the substitution of 45° for 30° , may probably be shown to hold true for the tangent and cotangent.

RECENT PUBLICATIONS.

REVIEWS

AMERICAN MEN OF SCIENCE.

American Men of Science. A Biographical Directory. Edited by J. McK. CATTELL and D. R. BRIMHALL. Third edition. Garrison, N. Y., The Science Press, 1921. 4to. 8 + 808 pp. Price \$10.00.

The first edition of this work, published early in 1906, contained brief sketches of about 4,000 living American¹ men and women of science, the second edition, published late in 1910, about 5,500; the present edition contains some 9,500 sketches. The increase in the number of sketches measures roughly the increase of scientific workers.

In the first edition a star was prefixed to the subject of research in the case of one thousand of the sketches of students of the natural and exact sciences in the United States. In each of the twelve principal sciences² the names were arranged in the order of merit by ten leading students of the science. In this way the subjects of research of 80 mathematicians and 50 astronomers were starred.

In the second edition, the thousand leading men of science were determined in the same manner as in the first edition, stars being added to the subjects of research in the case of 269 new men; of these 20 were mathematicians. Their names, the names of the original 80 mathematicians, as well as of the 29 new mathematicians whose subjects of research are starred in the present edition, are given below.

It will be observed that in all editions the total number of sketches, in connection with which mathematics is starred, is 129. Of these, 11 refer to those who have died. There remain 118 living mathematicians with a star in the present edition, since a star once given in a sketch is not removed in subsequent editions. Hence 38 of these mathematicians are now no longer regarded as among the 80

¹ This term is interpreted as applying not only to natives of the United States and of the Dominion of Canada, but also to foreigners temporarily resident in these countries; for example: O. Bolza and P. Boutroux.

² Mathematics, physics, chemistry, astronomy, geology, botany, zoölogy, physiology, anatomy, pathology, anthropology, and psychology.

to be counted in the thousand leading men of science. The names of 29 of these 80 are, as already indicated, given below; but the membership of the remaining particular group of 51 is, except to the editors, unknown.

The names of those for whom mathematics is starred are as follows: R. E. Allardice (2, 3), R. C. Archibald (3), H. Bateman (3), W. W. Beman (1, 2, 3), A. A. Bennett (3), G. D. Birkhoff (2, 3), E. M. Blake (1, 2, 3), H. F. Blichfeldt (1, 2, 3), G. A. Bliss (2, 3), H. Blumberg (3), M. Bôcher (1, 2; d. 1918), O. Bolza (1, 2, 3), C. L. Bouton (1, 2, 3), E. W. Brown (1, 2, 3), W. E. Byerly (1, 2, 3), F. Cajori (1, 2, 3), R. D. Carmichael (3), A. S. Chessin (1, 2, 3), E. W. Chittenden (3), A. B. Coble (2, 3), F. N. Cole (1, 2, 3), L. L. Conant (1, 2; d. 1916), J. L. Coolidge (1, 2, 3), D. R. Curtiss (3), E. W. Davis (1, 2; d. 1918), L. E. Dickson (1, 2, 3), L. W. Dowling (2, 3), A. Dresden (3), W. H. Echols (1, 2, 3), H. T. Eddy (1, 2, 3) [Math., Mech., Eng.], J. A. Eiesland (2, 3), L. P. Eisenhart (2, 3), A. Emch (1, 2, 3), G. C. Evans (3), H. B. Fine (1, 2, 3), T. S. Fiske (1, 2, 3), W. B. Fite (1, 2, 3), W. B. Ford (2, 3), F. Franklin (1, 2, 3), E. Frisby (1, 2, 3) [Math., Ast.], O. E. Glenn (3), W. C. Graustein (3), T. H. Gronwall (3), J. G. Hagen (1, 2, 3) [Math., Ast.], G. B. Halsted (1, 2, 3) [Math., Logic], H. Hancock (1, 2, 3), M. W. Haskell (1, 2, 3), C. N. Haskins (2, 3), A. S. Hathaway (1, 2, 3) [Math., Physics], H. E. Hawkes (1, 2, 3), E. R. Hedrick (1, 2, 3), T. H. Hildebrandt (3), T. F. Holgate (1, 2, 3), L. S. Hulburt (1, 2, 3), E. V. Huntington (1, 2, 3), W. A. Hurwitz (3), J. I. Hutchinson (1, 2, 3), E. W. Hyde (1, 2, 3), D. Jackson (3), W. W. Johnson (1, 2, 3), L. C. Karpinski (3), E. Kasner (1, 2, 3), O. D. Kellogg (2, 3), C. J. Keyser (1, 2, 3), S. Lefschetz (3), D. N. Lehmer (2, 3), G. H. Ling (1, 2, 3), E. O. Lovett (1, 2, 3) [Math., Celestial mech.], P. Lowell (1, 2; d. 1916) [Math., Orientalism, Ast.], A. C. Lunn¹ (2, 3), E. McClintock (1, 2; d. 1916) [Math., Actuarial science], J. Maclay (1, 2; d. 1919), J. McMahon (1, 2, 3) [Math., Mathematical physics], W. D. MacMillan (3) [Math., Ast.], H. P. Manning (1, 2, 3), W. A. Manning (2, 3), H. Maschke (1; d. 1908), M. Mason (2, 3), W. H. Metzler (1, 2, 3), G. A. Miller (1, 2, 3), H. H. Mitchell (3), C. L. E. Moore (3), C. N. Moore (3), E. H. Moore (1, 2, 3), R. L. Moore (3), F. Morley (1, 2, 3), F. R. Moulton (1, 2, 3) [Math., Celestial mech.], H. B. Newson (1; d. 1910), W. F. Osgood (1, 2, 3), J. M. Page (1, 2, 3), J. M. Peirce (1; d. 1906), A. Pell (1, 2, 3; d. 1921), Mrs. A. Pell (3), J. Pierpont (1, 2, 3), M. B. Porter (1, 2, 3), A. Ranum (2, 3), R. G. D. Richardson (3), H. L. Rietz (2, 3), E. D. Roe (1, 2, 3) [Math., Ast.], W. H. Roever (3), P. L. Saurel (1, 2, 3) [Math., Physics²], Charlotte A. Scott (1, 2, 3), F. R. Sharpe (3), J. B. Shaw (1, 2, 3), C. H. Sisam (3), C. S. Slichter (2, 3), D. E. Smith (1, 2, 3), P. F. Smith (1, 2, 3), W. B. Smith (1, 2, 3) [Math., New testament criticism²], V. Snyder (1, 2, 3), H. F. Stecker (1, 2, 3), W. E. Story (1, 2, 3), W. I. Stringham (1; d. 1909), H. Taber (1, 2, 3), J. H. Tanner (1, 2, 3), H. D. Thompson (1, 2, 3), E. J. Townsend (3), H. W. Tyler (1, 2, 3), E. B. Van Vleck (1, 2, 3), O. Veblen (2, 3), J. H. Wedderburn (3), H. S. White (1, 2, 3), J. K. Whittemore (2, 3), E. J. Wilczynski (1, 2, 3), E. B. Wilson

¹ In the third edition the subject for A. C. Lunn is given as mathematical physics.

² This subject does not occur in the third edition.

(1, 2, 3), F. S. Woods (1, 2, 3), J. W. A. Young (1, 2, 3) [Math., Pedagogy of math.], J. W. Young (2, 3), A. Ziwet (1, 2, 3) [Math., Mech.].

Fourteen names in this list are followed by brackets [] enclosing the names of different fields of work, but mathematics coming first. The following 10 names are of others in connection with whom mathematics does not come first or else the subject is mathematical astronomy or mathematical physics:

J. G. Coffin (2, 3) [Mathematical physics], C. L. Doolittle (1, 2; d. 1919) [Ast., Math.], J. R. Eastman (1, 2; d. 1913) [Ast., Math.], G. W. Hill (1, 2; d. 1914) [Mathematical astronomy], F. H. Loud (1, 2, 3) [Ast., Math.], A. Macfarlane (1, 2; d. 1913) [Mathematical physics], R. C. Maclaurin (2; d. 1920) [Mathematical physics], B. O. Peirce (1, 2; d. 1914) [Mathematical physics], F. Slate (1, 2, 3) [Mathematical physics], J. B. Webb (1, 2; d. 19 ?) [Physics, Math.].

On pages 771-780 is given a very useful list of 1059 American men of science who died between January 1, 1903, and December 31, 1920. The years of birth and death are appended in each case where it was possible to determine such dates. The list includes not only the names of those whose names appeared in earlier editions, but also of others such as of G. M. Green. Certain events of very recent occurrence are recorded in the volume; for example, the death of A. Pell, January 26, 1921, and the appointment of J. R. Angell as president of Yale. It is not clear to the reviewer why a sketch of W. G. Everett, whose subject is ethics, should appear in the third edition.

Everyone interested in American science will wish to have this new *Biographical Directory* constantly at hand.

R. C. ARCHIBALD.

NOTES.

School Arithmetics is the title of a work, for grades I-VIII, by G. WENTWORTH and D. E. SMITH. (3 books, Boston, Ginn, 1920. 12mo. 6 + 282 + 16; 6 + 298 + 19; 6 + 346 + 19 pp. Price 72 + 76 + 92 cents.)

Professor J. H. M. WEDDERBURN's article "On equations of motion of a single particle," published separately January 24, 1921, appeared in part 1 (May), volume 41 (pp. 26-33), of *Proceedings of the Royal Society of Edinburgh*.

In *Popular Astronomy*, June-July, 1921, there is a reproduction of a photograph, taken on May 6, 1921, of a group with Professor Einstein at the Yerkes Observatory. Professor A. C. LUNN, of the University of Chicago, is a member of the group.

Comptes Rendus du Congrès International des Mathématiciens à Strasbourg, was published November 1, 1921, by Imprimerie Edouard Privat, Toulouse (paper, 100 francs; cloth, 125 francs).

In *Proceedings of the London Mathematical Society*, second series, volume 20, August 20, 1921, there is an article "Arithmetic of quaternions" by L. E. DICKSON. Compare 1921, 289.